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A Summary of Current Program, 7/1/63;
and Preliminary Report of Progress
for 7/1/62 to 6/30/63

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SOIL SURVEY INVESTIGATIONS
of the
SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

This progress report of U.S.D.A. and cooperative research is primarily a tool for use of scientists and administrators in program coordination, development and evaluation; and for use of advisory committees in program review and development of recommendations for future research programs.

The summaries of progress on U.S.D.A. and cooperative research include some tentative results that have not been tested sufficiently to justify general release. Such findings, when adequately confirmed will be released promptly through established channels. Because of this, the report is not intended for publication and should not be referred to in literature citations. Copies are distributed only to members of Department staff, advisory committee members and others having a special interest in the development of public agricultural research programs.

This report also includes a list of publications reporting results of U.S.D.A. and cooperative research issued between July 1, 1962 and June 30, 1963. Current agricultural research findings are also published in the U.S.D.A. publications, Agricultural Research and Farm Index. This progress report was compiled in the Soil Survey Investigations, Soil Conservation Service, U.S. Department of Agriculture, Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D. C.
July 1, 1963

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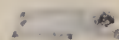


TABLE OF CONTENTS

	Page
Introduction.....	ii
Area No. 1: Soil-Geomorphology Relationships.....	1
Area No. 2: Soil and Plant Relationships.....	3
Area No. 3: Soil Genesis, Characterization, and Classification.....	5
Line Project Check List.....	8

INTRODUCTION

The Soil Survey is a cooperative program to identify, map and classify the soils of the United States, to interpret the significance of the kinds of soil to use and behavior, and to publish the findings. The Soil Conservation Service, other Federal Departments and independent agencies, the various State Agricultural Experiment Stations, and other State and local agencies cooperate in the program.

Soil Survey Investigations, located in the Soil Survey of the Soil Conservation Service, conducts research in the fields of soil classification, soil genesis, soil geography, and measurement of soil properties.

Quantitative measurements of soil properties are essential to soil classification and interpretations of soil surveys. The processes and interactions that have produced these properties are called soil genesis. These may sometimes be studied in the laboratory. More often, because they are very slow, they may be studied only by geographic correlation. That is, a given property or set of properties may be found associated only with a particular climate and vegetation, and there only on the parts of the landscape that have a particular age. Thus, studies of soil geography, when accompanied by studies of geomorphology, plant ecology, climatology and other disciplines, are usually essential parts of studies of soil genesis. If the soil scientist understands how the soils form, he can make his maps more accurately and efficiently because he is able to predict where he will find a given kind of soil on the landscape.

AREA NO. 1: SOIL-GEOMORPHOLOGY RELATIONSHIPS

Problem. The cycles of erosion, deposition, and stability of the landscapes throughout the past few hundred thousand years have been important in determining not only the kinds of soil and their positions in the landscape, but the kind and amount of erosion that results from the use of the soils. The soil scientist needs to understand how the landscape evolved in order to make soil maps efficiently and accurately, and he needs to know whether the erosion that he sees is natural or is induced by the land use if he is to assess the possibility of erosion control by vegetation.

USDA PROGRAM

The Department has a continuing program of study involving geologists and soil scientists, with occasional temporary assistance of scientists in other fields, to study landscape evolution as it relates to soil genesis. Studies are underway in four locations representing the widely contrasting environments of North Carolina, Iowa, New Mexico, and Western Oregon. In addition, preliminary studies are underway in Hawaii. The studies are made in cooperation with the Agricultural Experiment Stations in these States and, where there is interest, with the State Geological Surveys, and the U. S. Geological Survey.

The Federal contribution to research in this area totals 14 professional man-years.

REPORT OF PROGRESS

1. Studies in all projects have shown that there have been repeated cycles of erosion and sedimentation, followed by relative stability of the landscape. Dating of the cycles during the past 40,000 years has been possible with radioactive carbon studies of wood and charcoal. Studies of the possibility of extending the dates by the Potassium-Argon ratios are underway at University Park, New Mexico.

Identification and mapping of soils and surficial deposits have been completed at University Park, New Mexico and reports are in preparation. Studies of the sources of the carbonates in the caliche, or calcrete, are continuing. Dust is considered the most probable source in soils whose parent materials lack carbonates. Quantitative measurements of the carbonates in the dust deposited on the soils is in the third year. Preliminary studies of the causes of gullies or arroyos in the desert landscapes are beginning.

2. In studies on the Coastal Plain in North Carolina, extensive areas of soils that contain laterite have been identified with ancient surfaces, either early Pleistocene or Pliocene in age. Pans that resemble fragipans have been related to surfaces of intermediate age, but no precise methods of dating are available. Pleistocene eolian movement of sands has been identified and attempts are being made to date the blowing with radioactive carbon. Work is being extended into the lowest and youngest parts of the coastal plain.

3. Work in Iowa is continuing on the age and sequence of the glaciations that covered the northern half of the State. The data collected to date are conflicting but raise serious questions about the currently accepted sequence of glacial advances. Studies of post-glacial changes in vegetation and climate are continuing by analyses of pollen in the peat bogs. They support work in other parts of the country showing that the prairies of the midwest States replaced earlier forests only a few thousand years ago.

PUBLICATIONS REPORTING RESULTS OF USDA RESEARCH

Ruhe, Robert V. 1962. Age of the Rio Grande Valley in Southern New Mexico. Jour. Geology 70: 151-167.

Daniels, R. B., Rubin, M., and Simonson, G. H. 1963. Alluvial chronology of the Thompson Creek Watershed, Harrison County, Iowa. Am. Jour. Sci. 261: 473-487.

AREA NO. 2: SOIL AND PLANT RELATIONSHIPS

Problem. There is an intimate relationship between the soil and the plants it supports. The soil affects the plant but is in turn affected by the plant. The plants that grow on a soil under use are rarely the same as those that grew in the wild. The changed vegetation will inevitably change the soil. The direction of the changes in the soil can be predicted, but not the amount of change. The plants, introduced into new environments, may be affected in unpredictable ways by the soils. Some quantitative data are essential to the interpretations made of the soil surveys.

USDA PROGRAM

The Soil Conservation Service program includes soil scientists and woodland and range conservationists working together in cooperation with other agencies in the Department and with the State agricultural experiment stations. Studies are underway of soil-plant relationships on the ranges in Utah, Idaho and adjacent States, of the shelterbelts and windbreaks on the Great Plains, and of mineral deficiencies and toxicities in forage throughout all States.

The Soil Conservation Service contribution to research in this area totals six and one-half professional man-years.

REPORT OF PROGRESS

1. Studies of virgin sites in the Chestnut and Brown soil zones have shown that not only the amount but the botanic composition of herbage varies from year to year. The contribution to herbage by an individual species depends not only on the amount of precipitation, but also on the season when the precipitation falls, and the state of the soil (frozen or unfrozen). Soil features that have been attributed to erosion, such as pedestaling of plants, is common in virgin soils and may be produced by frost as well as erosion.

2. Studies of soils and their relationship to deficiencies of cobalt in forage were completed in New England. Cobalt-deficient forage is associated primarily with coarse textures (sands and loamy sands) in soils that develop in glacial drift composed largely of granitic materials from the White Mountains. Glacial drift originating in other regions has more cobalt.

The map of the United States showing areas of soils associated with mineral deficiencies or toxicities has been revised with the cooperation of the U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, New York.

The occurrence of soils that produce molybdenum-toxic forage in Oregon has been determined, and a relationship to granitic parent materials seems probable. Work is continuing.

PUBLICATIONS REPORTING RESULTS OF USDA RESEARCH

Passey, H. B. and Hugie, V. K. 1963. Some plant-soil relationships on an ungrazed range area of Southeastern Idaho. Jour. Range Management 16: 113-118.

_____ 1963. Fluctuating herbage production on an ungrazed Sierozem soil in Idaho. Jour. Soil and Water Conservation 18; 1: 8-11.

Hugie, V. K. and Passey, H. B. 1963. Cicadas and their effect upon soil genesis in certain soils in Southern Idaho, Northern Utah, and Northeastern Nevada. Soil Science Society of America Proceedings 27: 78-82.

Passey, H. B. and Hugie, V. K. 1963. Variation in bluebunch wheatgrass in relation to environment and geographic location. Ecology 44: 158-161.

AREA NO. 3: SOIL GENESIS, CHARACTERIZATION, AND CLASSIFICATION

Problem. It has been estimated that there are at least 75,000 kinds of soil in the United States. We need to be able to apply the results of research or experience obtained on one soil to the other soils on which the observations are valid. We classify the soils to help us transfer this experience. We base the classification upon quantitative knowledge of the physical and chemical properties of the soils, and we select the properties through our knowledge of soil genesis and soil-plant relations. Thus, the extension of our experience with soils is based on knowledge of the properties of the soils and how these properties were acquired.

USDA PROGRAM

The Soil Conservation Service maintains laboratories at Beltsville, Md.; Lincoln, Nebr.; and Riverside Calif., for the study of soils. The selection of soils to be studied and sampling sites is in cooperation with the soil scientists who have technical responsibility for the soil survey program in the States. The work covers soils in all 50 States and Puerto Rico.

About 30 professional man-years of work are involved.

REPORT OF PROGRESS

1. Characterization analyses were completed on about 2,000 samples from 262 profiles collected from 78 counties in 35 States, Puerto Rico, and a few foreign countries. From 10 to 15 chemical and physical determinations were made on each sample. Partial analyses were made on an additional 200 samples to resolve specific problems in soil mapping. Mineralogical analyses were made on about 450 samples. A large backlog of unpublished data exists, and preparations are underway to publish the characterization data.

Studies of the distribution of radioactive strontium in soils continue. The studies in the past year show that 95 percent or more of the strontium is still in the upper six inches of the soils that have not been plowed.

Studies of pastures in Virginia show that the strontium remains in the soil where it first falls and does not become concentrated in depressions or at the base of a slope where water is apt to be concentrated. Studies of cultivated areas are underway.

2. More rapid and more reliable method of measuring the physical and chemical properties of soils continue under study. Work is underway on methods for measuring permeability to determine suitability of soils for

septic tank fields, and to measure available water-holding capacities of soils. A method using fragments of undisturbed soil has been devised that shows promise of measuring available water-holding capacities of soils that lack stratification.

Chelometric methods for measurement of calcium and magnesium in soils seem usable unless volcanic glass is present in large amounts. A more accurate method was developed for the extraction and concentration of radioactive strontium in soils.

A method has been developed that permits quantitative optical estimation of the volume of clay that has been moved within the soil.

3. Studies of cements in hardpans have shown that opal is the major cement in the hardpans of California and western Oregon, and in some of the hardpans of Nebraska. Opal also has been identified as the cement in some hardpans in Virginia.

In contrast, the caliche cemented with lime contains an appreciable amount of silica; but the silica seems to be in the form of sepiolite rather than opal. Sepiolite has not been previously identified as having been formed in soils.

Studies of oriented clays in soils show that the orientation produced by clay movement may be distinguished from the orientation produced by wetting and drying.

Volcanic glass has been found to be a widespread constituent of the soils of the Western States, and is also found in relatively large amounts in the loess of Nebraska.

Kaolin crystals of sand and silt size have been identified in soils of the Southeastern States and Puerto Rico. The larger crystals have commonly been mistaken for mica. These crystals of kaolin apparently are responsible for some of the difficulties that have been experienced with engineering tests and classifications, and for the poor relationship between some of the physical and chemical properties in many of the soils.

PUBLICATIONS REPORTING RESULTS OF USDA RESEARCH

- Alexander, L. T. and Cady, J. G. (Dec.) 1962. Genesis and hardening of laterite. Tech. Bull. 1282, 90 pp.
- Coleman, N. T., LeRoux, R. H., and Cady, J. G. 1963. Biotite - hydro-biotite - vermiculite in soils. Nature 198: 409-410.
- Flach, K. W. 1963. Soil investigations and the 7th Approximation. Soil Sci. Soc. Am. Proc. 27: 226-228.
- Hardy, E. P., Jr., List, R. J., Machta, L., Alexander, L. T., Allen, J. S., and Meyer, M. W. (Nov.) 1962. Strontium-90 on the Earth's surface II. U. S. Atomic Energy Comm., Div. of Tech. Inf. TID-17090.

- Hendricks, S. B., Cady, J. G., and Flach, K. W. 1962. Petrographic studies of mineral translocation in soils. Transactions, International Soil Conference, New Zealand.
- Johnson, W. M., Cady, J. G., and James, M. S. 1962. Characteristics of some brown Grumusols of Arizona. Soil Sci. Soc. Am. Proc. 26: 389-393.
- Orvedal, A. C. and Austin, M. E. 1963. Some Geographic Aspects of the Seventh Approximation. Soil Sci. Am. Proc. 27: 228-231.
- Simonson, C. H. and Axley, J. H. 1963. High frequency titrimetry of soils and clays: Methodology, theory, and nature of the Ba-Mg exchange reaction. Soil Sci. Soc. Am. Proc. 27: 26-31.
- Sivarajasingham, S., Alexander, L. T., Cady, J. G., and Cline, M. G. 1962. Laterite. Advances in Agronomy 14: 1-60.
- Uehara, G., Flach, K. W., and Sherman, G. D. 1962. Genesis and micro-morphology of certain soil structural types in Hawaiian Latosol and their significance to agricultural practice. Transactions, International Soil Conference, New Zealand.

Line Project Check List -- Reporting Year July 1, 1962 to June 30, 1963

Work & Line Project Number	:	Line Project Title	:	Work Locations During Past Year	:	Line Proj. Incl. in Summary : Area & of : Sub- Progress:Subheading
SCS-1-1-1(SG)	:	Soil erosion and arroyo formation, New Mexico.	:	University Park, N. Mex.	:	Yes : 1-1
SCS-1-1-2(SG)	:	Landscape evolution and soil development, Coastal Plain, North Carolina.	:	Raleigh, N.C.	:	Yes : 1-2
SCS-1-1-3(SG)	:	Evolution of Iowa landscapes and soils and the effects of environment.	:	Ames, Iowa	:	Yes : 1-3
SCS-1-1-4(SG)	:	Landscape evolution and soil development, Willamette Valley, Oregon.	:	Corvallis, Oreg.	:	No :
SCS-1-1-5(SP)	:	Soil-climate vegetation relationships on range- lands in Western United States.	:	Salt Lake City, Utah	:	Yes : 2-1
SCS-1-1-6(SP)	:	Soil-tree relationships of shelterbelts and windbreaks in Great Plains States.	:	Lincoln, Nebr.	:	No :
SCS-1-1-7(SP)	:	The use in soil classification of soil properties that lead to nutritional troubles in animals.	:	Ithaca, N.Y.	:	Yes : 2-2
SCS-1-1-8(SL)	:	Soil characterization.	:	Beltsville, Md.;	:	Yes : 3-1
	:		:	Lincoln, Nebr.;	:	
	:		:	Riverside, Calif.	:	
SCS-1-1-9(SL)	:	Development and improvement of methods of laboratory work.	:	Beltsville, Md.;	:	Yes : 3-2
	:		:	Lincoln, Nebr.;	:	
	:		:	Riverside, Calif.	:	
SCS-1-1-10(SL)	:	Soil Genesis: Processes of development of soil profile features.	:	Beltsville, Md.;	:	Yes : 3-3
	:		:	Lincoln, Nebr.;	:	
	:		:	Riverside, Calif.	:	
SCS-1-1-11(SL)	:	Origin of soil parent materials.	:	Beltsville, Md.;	:	Yes : 3-3
	:		:	Lincoln, Nebr.;	:	
	:		:	Riverside, Calif.	:	
	:		:		:	